

# Innovation in the Design & Construction of a Concrete Overlay

## TERRA Pavement Conference

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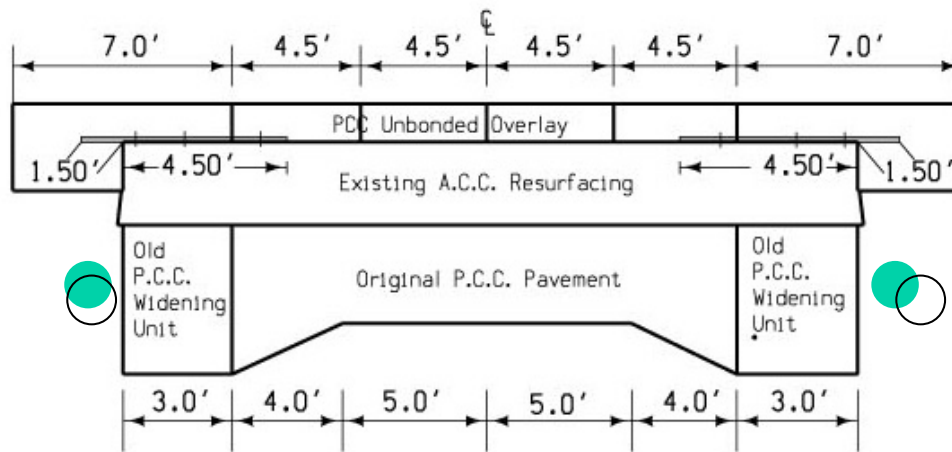
# Innovation Objectives

- Build a two lane PCC overlay under traffic
- Accelerate the construction where possible
- Construction innovations utilized
- Design innovations for future projects
- Potential cost savings in two vs. single lane overlay paving









Notes:

- ① Extend existing expansion joints in kind in new pavement.

TYPICAL CROSS SECTION  
AND JOINTING DIAGRAM  
PCC UNBONDED OVERLAY  
WITH PARTIALLY PAVED SHOULDERS

- 1938 original pavement 18'-20' wide
- PCC widening unit
- Panel sizes, rebar for widening unit
- Importance of collecting pavement history, dates, thicknesses, PCI
- Talk to maintenance staff about pavement problem areas, special conditions



# Overlay Communication Innovation

- Preconstruction conference (agencies/contractor)
- Preconstruction conference (owner/contractor/ **nearby residents**)
- Biweekly construction team meetings
- Pre-paving team meeting



# Stage Work to Meet Both Public & Construction Goals Efficiently

- Stage I – Pre-paving Items (patching, subdrainage, grading & ditches, erosion control, & survey control)
- Stage II – Bridge approaches & paving notches, bridge railing, shoulder strengthening & transitions
- Stage III – Milling & Intersection preparation
- Stage IV – Paving, shouldering & pavement marking.



# Subdrain Construction Innovation

- For most efficient project work, use a 2 mile work zone where possible
- Precut the top of trench to improve trencher production





# US 18 Subdrain Installation Preparation



- Rock saw loosens the shoulder material to speed up trenching
- Encountered rubble – tabulate on plans

# Full Depth Patching Construction Innovation

- Verify estimates before final plan turn in
- Repair full panels and match joints to allow free movement
- Repair full pavement width transverse joints for best performance
- Encourage multiple 2 mile work zones for sawing & patch placement efficiency





# US 18 Full Depth Patch Candidate

Only tie longitudinal joint



**Isolate the patch and match with overlay joints**

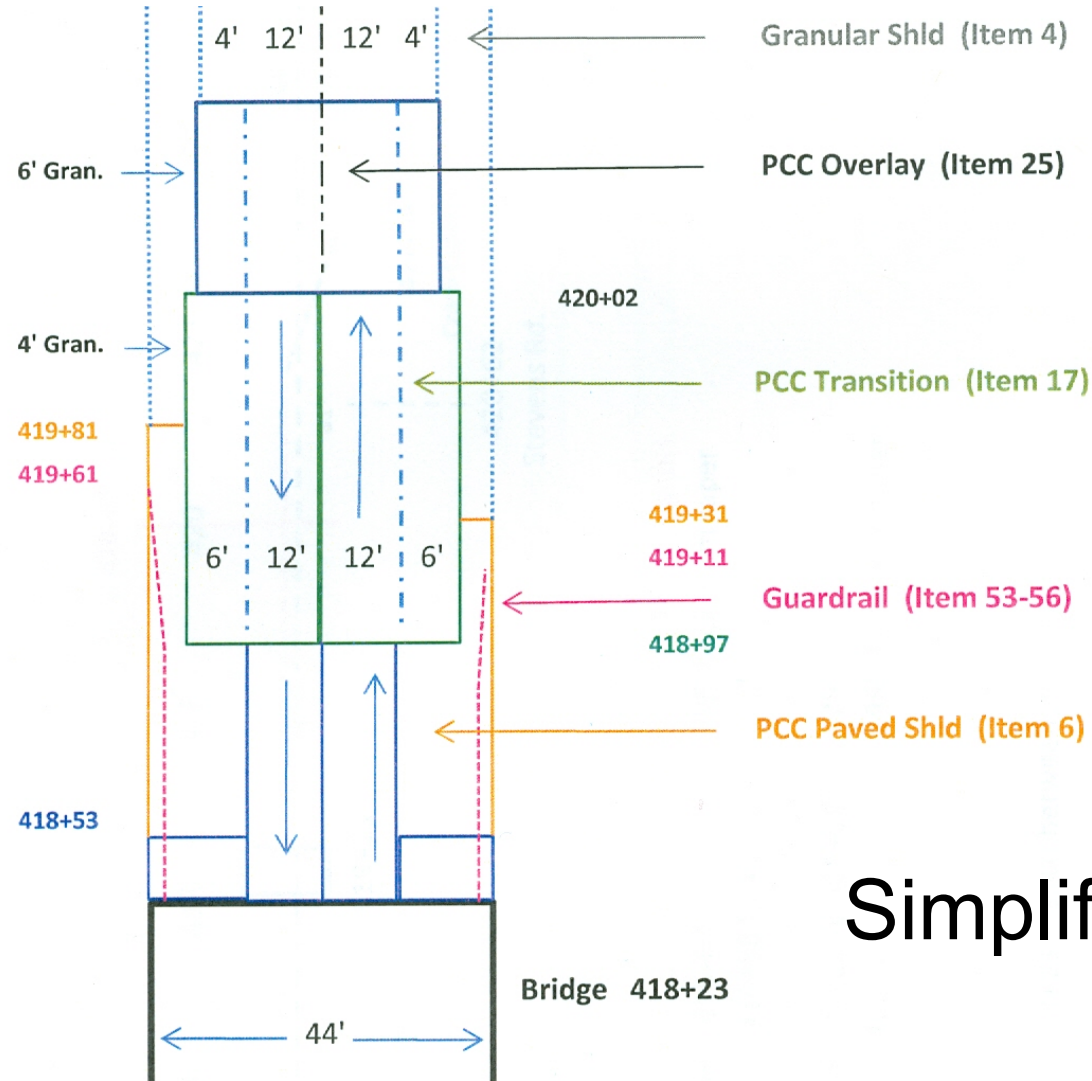


# Transition Construction Innovation

- Design bridge approaches & transition pavements for machine paving
- Build shoulder strengthening units only on one side where pavement widening is employed
- Extend the TBR to accommodate the approach, transition & TBR approach lengths
- Develop transverse joints in strengthening to match those in the overlay
- Mill shoulder strengthening to a depth of 8 inches below profile elevation



# US 18 Bridge Approach Paving Plan



Simplify this plan

# US 18 - Layout Recommendations

- Layout
  - Follow current IDOT Standards
  - Bridge approach, transition length, mainline
  - TBR length
  - Use widest section and build it!
  - Design bridge approaches & transition pavements for machine paving





# Transition Construction Innovations

- Transition from the low point of bridge approach to the mainline: 1 inch to 25 foot
- Run-outs: 1 inch to 6 feet (temporary use)
- Use the bridge approach & transition slab to develop an approach vertical curve of 300 ft or greater (from bridge to mainline)
- Coordinate the bridge approach vertical curve with the pavement model profile.



# US 18 Typical Bridge Approach/Transition Work



- Note all the variable widths and separate pours
- No need to remove shoulder strengthening- Mill top 1.5"
- Set shoulder strengthening area to a depth of 8 inches below profile grade line

# Surface Survey vs. Desired Concrete Yield Innovation

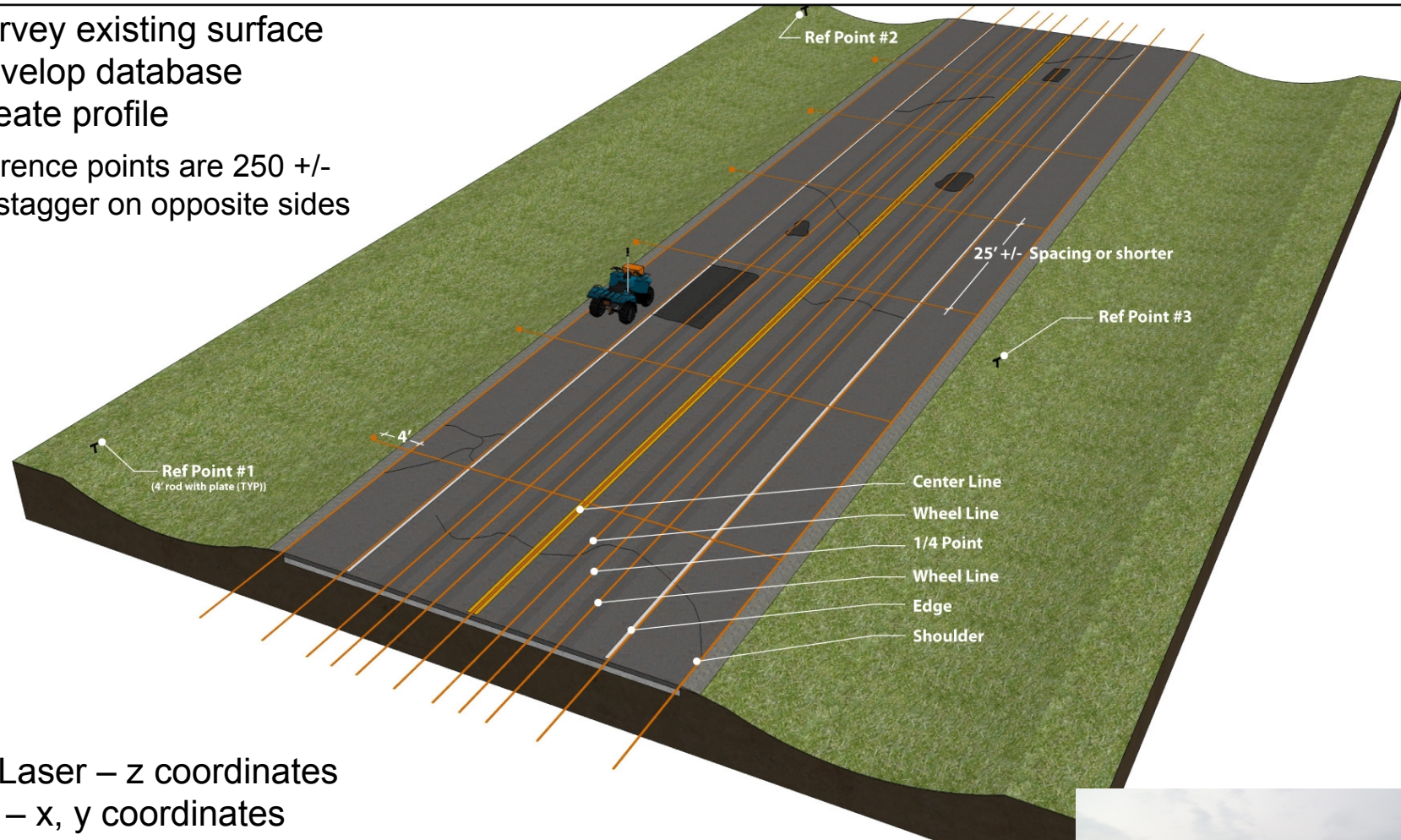
- Contract required a three line survey for profile establishment.
- Contract required 1/2" milling depth to remove surface treatment on west 2/3 of project.
- Project team conducted one mile test section on various line options & different cross section spacing (25' & 50') to assess yield and overruns
- Optimum yield was obtained with nine line profile at 50 ft. intervals before milling
  - Milling limits where 1/2" to 1 1/2" deep at centerline and 2% cross slope.
  - Yield changed from 26% average overrun to average of 6% after milling to new profile depth.





- Survey existing surface
- Develop database
- Create profile

Reference points are 250 +/-  
and stagger on opposite sides



ATV Laser – z coordinates  
GPS – x, y coordinates



## Survey – GPS / Total Stations





# US 18 Longitudinal Joint Repair, Locate & Excavate



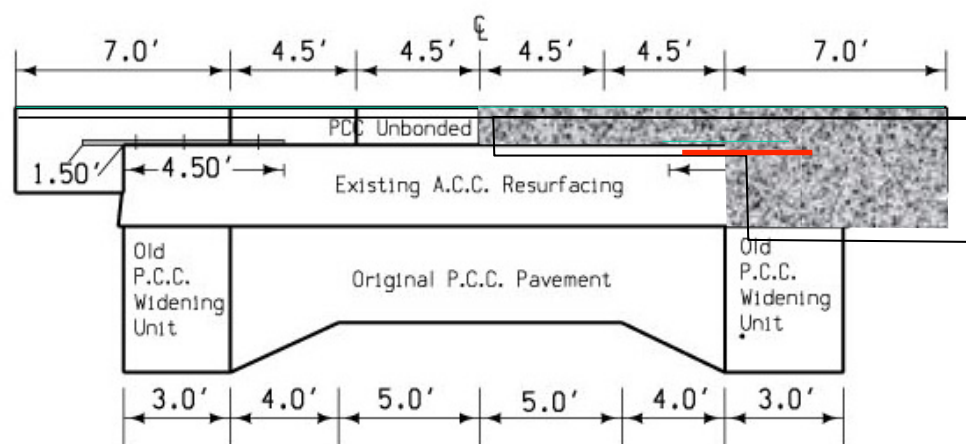
- Core these areas to confirm rehabilitation
- After milling, no void was encountered

# Milling of HMA Innovations

- 7' wide mill to mill trench & existing widening
- Provide for a vertical edge
- Mill to given profile & cross slope to improve PCC yield
- Centerline pass – by total stations (25 to 30 ft. per minute)
- Remaining removal width by sensor off milled surface (1/2 to 1 mile per day)







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TYPICAL CROSS SECTION  
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- Consider milling existing asphalt above widening unit
- Eliminates a joint
- Reduces bar length

# Tie Steel Placement Innovations

- Develop methods for automating location of the 5' & 6' tie bars placed at 30" spacing
- Develop alternate methods of securing bars to HMA to resist turning of bar by concrete
- 18" over original pavement and 18" into new widening





# US 18 Widening Bar Placement



- Bar marking device
- Note bars on working crack.
- Bars have also been secured to pavement with 2 part epoxy with success on other projects

# Paving Operation Innovations

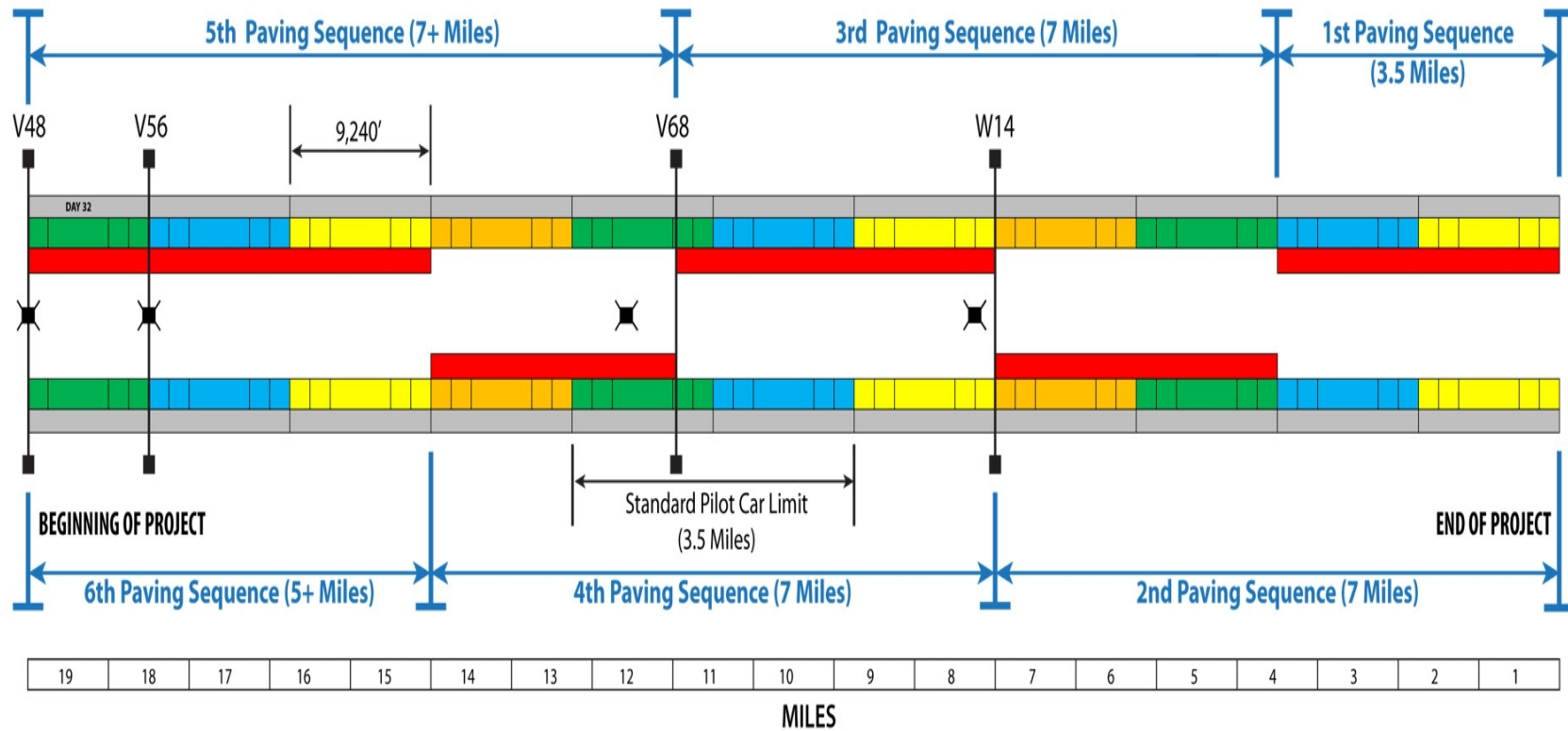
- Identify the project paving goals in terms of time & access requirements
- Require the contractor to develop the paving plan for agency approval
- Evaluate plans on the basis of contractor ability to deliver pavement, shoulders & markings in a continuous & timely manner
- Consider haul road needs based on limitations placed on contractor paving plans



# Paving Schedule

Fredericksburg

West Union



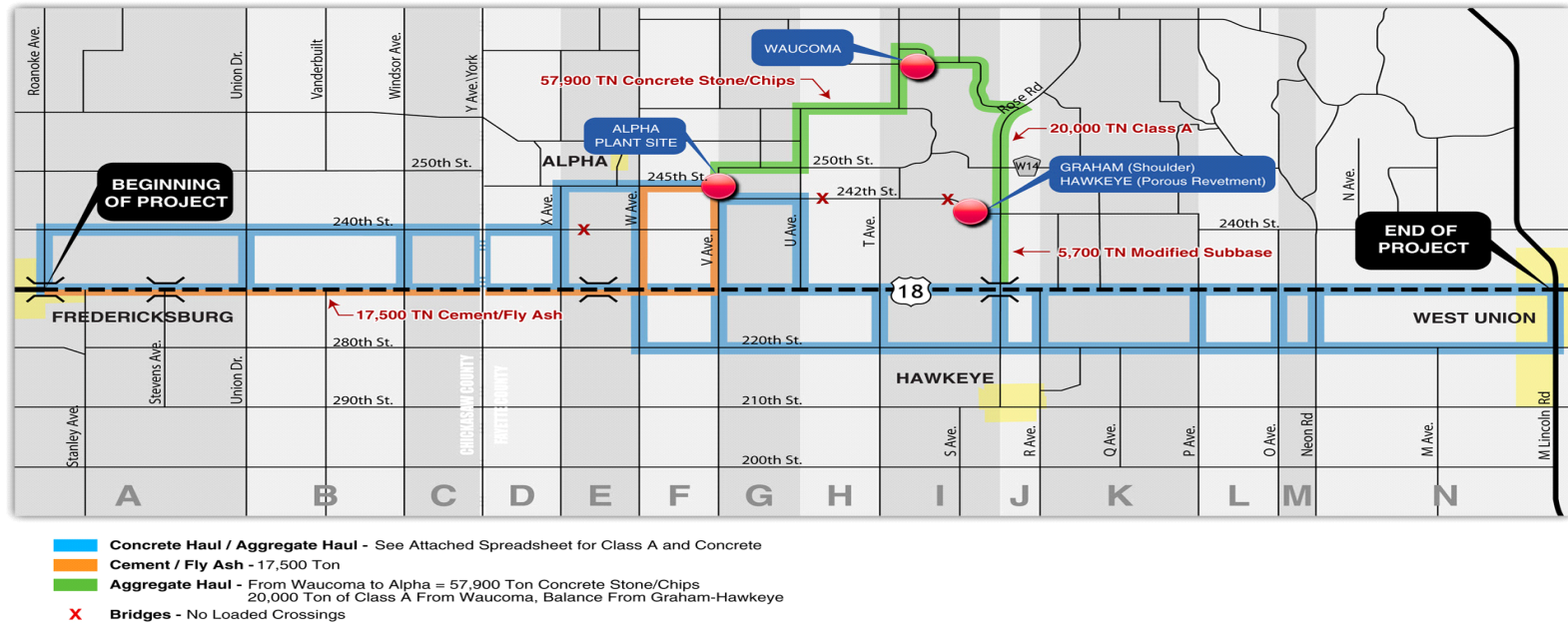
PAVING SEQUENCE EAST TO WEST

**Pre-Paving:** Milled Trench, Install Steel, Clean Surface  
**Paving:** Pavement and Safty Wedge  
**Post-Paving:** Rock Shoulder, Striping Centerline, Signs

GRANULAR SHOULDER  
 SAFETY WEDGE  
 0.25 MILE



# US 18 Haul Road Map



- Obeying traffic control and concrete haul time limits required the use of many haul roads and increased damage to secondary and local roads
- Typically haul time is limited to 30 min. however an increased dosage of water reducer was approved giving an additional 15 min of haul time.
- The contractor developed a haul rote to get PCC to the paving area in 30-45 min.



# Paving/Traffic Control Plan Innovations

- Encourage multiple work zones for each construction activity
- Shoulder & mark as maturity is reached
- Use the pilot car 24/7 to eliminate centerline wedge construction
- Encourage bridge transition & approach construction by mainline paving equipment
- Close only cross roads in paving area & only one paved cross road per 5 miles of construction area



# US 18 Single Lane Paving With Through Traffic





# US 18 Centerline Wedge Construction





# US 18 Centerline Wedge Removal





# Paving Operations Innovations

- Encourage stringless paving to ease thru & construction traffic
- Consider 5 days/mile construction limit on contract
- Consider two lane paving vs. one lane
- Consider a staged (rolling) detour

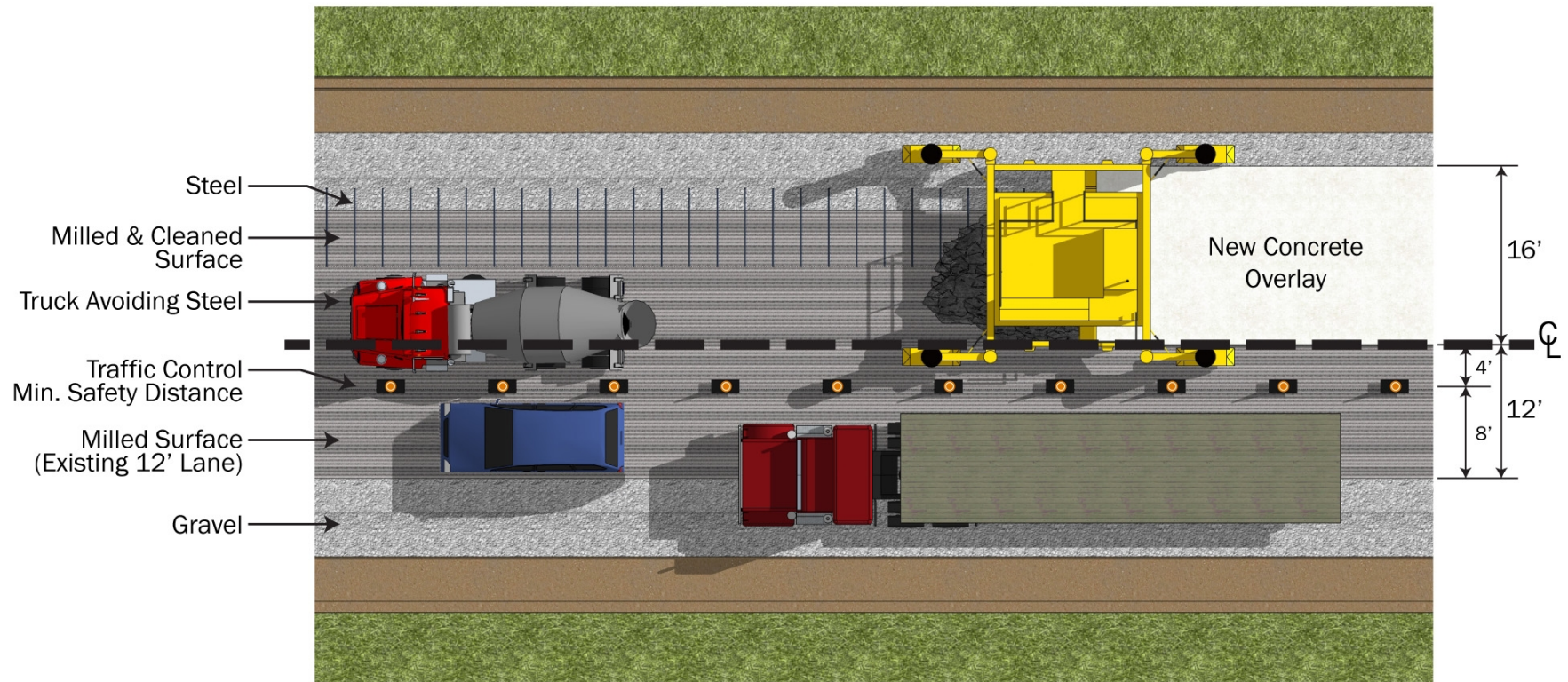


# US 18 Paving Train



- Two total stations on same side of road for paver control
- Stringless system costs about \$40,000
- Truck proximity to widening tie bars – special attention is needed on the bars to make sure they remain in place

# Traffic Shift



US18 Bonded Concrete Overlay



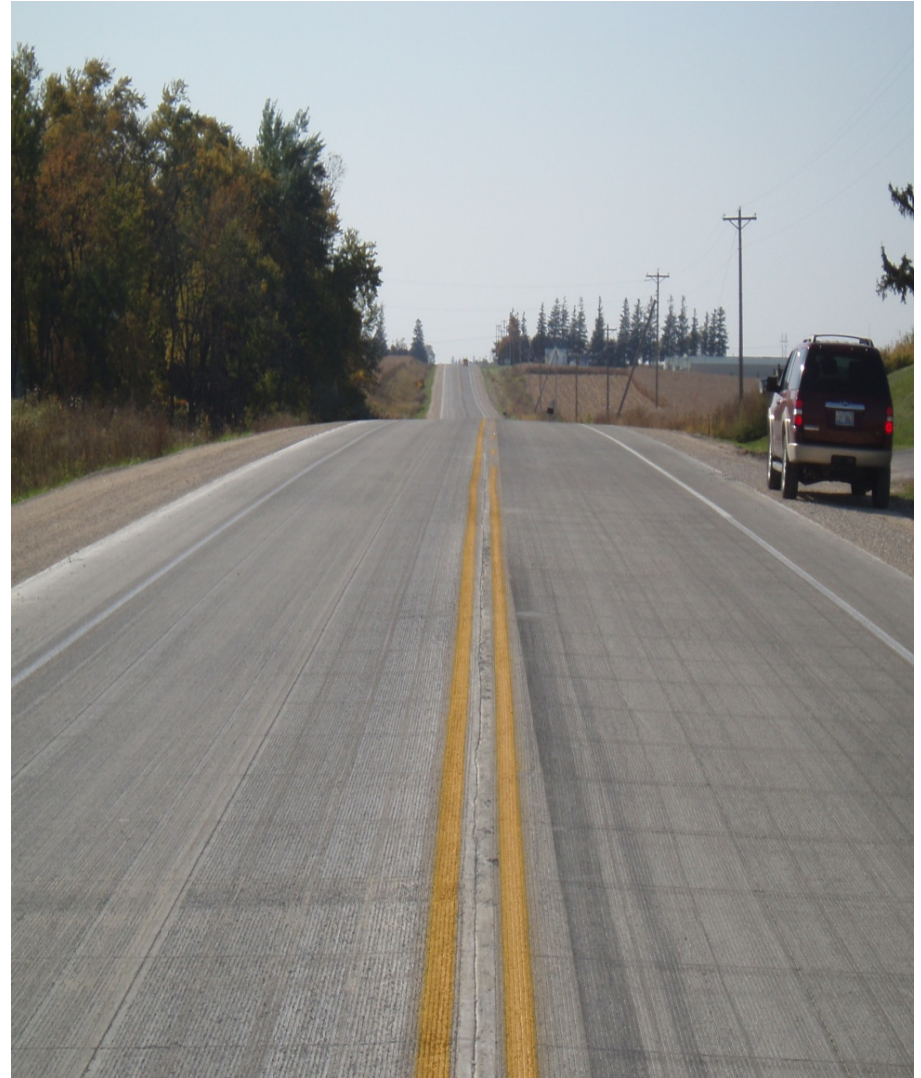
# PCC Overlay Paving



- Peak hour local traffic at the paver
- Note the cone locations
- Note right side shoulder area needed for trucks to get around each other



# US 18 Final Product



# Future Design Innovations

- Reduce construction time to 5 days per mile
- Reduce plan volume from 94 to 40 pages or less
- Supply construction limitations & require the contractor to develop the paving plan & traffic control plan for review
- Mill out a portion of existing widening units to improve performance & reduce costs
- Consider two lane/closed road vs. one lane/with through traffic for each overlay project



# Thank you

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